

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : A. Glazounov	Art Unit : 2834
Serial No. : 10/529,065	Examiner : Jaydi A. San Martin
Filed : October 24, 2005	Conf. No. : 2563
Title : PIEZOELECTRIC TRANSFORMER PROVIDED WITH INTERNAL COPPER ELECTRODES	

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PRE-APPEAL BRIEF REQUEST FOR REVIEW

We request that a panel of Examiners review the rejections made by the Examiner because of the deficiencies discussed below.

I. Rejections

Claims 10, 11 and 16 were rejected over Inoue (U.S. 5,118,982); and claim 12 was rejected over Inoue in view of Kikko (JP 04-074777A).

II. Questions For Review

We respectfully request the panel to review the following issue: whether independent claim 10 was properly rejected over Inoue, whether taken alone or in combination with Kikko. We reserve the right to expand the issues or to present new issues when filing an appeal brief.

III. Independent Claim 10

Independent claim 10 is set forth below.

10. A piezoelectric transformer comprising:  
ceramic layers comprising a hard piezoelectric material that has a general composition of  
 $\text{Pb}[(\text{Zr}_x\text{Ti}_{1-x})_{1-y}(\text{Mn}_{1/3}\text{Nb}_{2/3})_y]\text{O}_3$ ; and  
an electrode layer comprising copper, the electrode layer being disposed between the ceramic layers.

Inoue is not understood to disclose or to suggest at least the features of claim 10 that are underlined above.

The Office Action states the following with respect to claim 10:

2. Claim 10-11 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Inoue et al. (US5118982).

Regarding claim 10, Inoue discloses a piezoelectric transformer (figures 2-11, 14, 16A-B, 18, 25-26, 29) comprising: ceramic layers comprising a hard piezoelectric material (PZT, PT); and an electrode layer comprising copper (column 11, lines 43), the electrode layer being disposed between the ceramic layers.

We note that this latest Office Action does not even attempt to identify where Inoue discloses the claimed general composition of  $\text{Pb}[(\text{Zr}_x\text{Ti}_{1-x})_{1-y}(\text{Mn}_{1/3}\text{Nb}_{2/3})_y]\text{O}_3$ . The Office Action merely identifies a "hard piezoelectric material", but not a material having the claimed composition.

In this regard, Inoue does describe use of a lead titanate zirconate piezoelectric ceramic<sup>1</sup>, in addition to a  $\text{PbTiO}_3$  ceramic<sup>2</sup>. As is believed to be known to those of skill in the art, a lead titanate zirconate piezoelectric ceramic has the general formula of  $\text{Pb}[\text{Zr}_x\text{Ti}_{1-x}]\text{O}_3$ , where  $0 < x < 1$ .<sup>3</sup> However, we do not understand Inoue to disclose or to suggest including Mn or Nb in the general composition of its lead titanate zirconate piezoelectric ceramic, much less in the specific proportions that are set forth in claim 10.

The most detailed discussion of Inoue's lead titanate zirconate piezoelectric ceramic appears to be in column 10. There, Inoue describes fabricating the lead titanate zirconate piezoelectric ceramic, as follows:

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<sup>1</sup> See, e.g., col. 8, lines 30 to 33; col. 9, lines 20 to 25; col. 10, lines 21 et seq.; and col. 14, lines 32 to 38.

<sup>2</sup> See, e.g., col. 7, lines 46 to 48 and col. 9, line 34

<sup>3</sup> [www.wikipedia.org](http://www.wikipedia.org), [http://en.wikipedia.org/wiki/Lead\\_zirconate\\_titanate](http://en.wikipedia.org/wiki/Lead_zirconate_titanate), accessed on April 24, 2009.

Lead titanate zirconate piezoelectric ceramic 611 which is a high dielectric piezoelectric ceramic was made as follows: PbO, ZrO<sub>2</sub> and TiO<sub>2</sub> as main components, and very small amounts of impurities were weighed, placed, along with water as a dispersion medium, in a ball mill pot and mixed for 40 hours, proceeding in substantially the same way as in making the PbTiO<sub>3</sub> piezoelectric ceramic. The low dielectric constant ceramic 62 and high dielectric constant ceramic 61 obtained in the above-stated way were coated on their opposed surfaces with a glass paste consisting of a lead glass, ethyl cellulose and a solvent to a thickness of about 15  $\mu$ m by the screen printing technique, adhered together, and heated at 650° C. for 30 minutes. The thus-obtained integrated product composed of the ceramics 61, 62 having low and high dielectric constants, respectively, was then coated on the side surfaces with a silver paste consisting of silver and glass frit by the screen printing technique, and baked at about 500° C. to form side conductor layers 153, 154, 155 and 156. The resultant was kept at 100° C. in silicon oil, and DC voltage of 5 kV was applied between the side conductor layers 153 and 154, and between side conductor layers 155 and 156 to polarize the piezoelectric ceramics 61, 62. In this way, a piezoelectric ceramic transformer was obtained. If polarization directions of the low and high dielectric constant piezoelectric ceramics 61, 62 are the same, then the polarities of the side conductor layers 155, 156 in FIG. 16 become changed, and hence it is preferred that for attaining higher breakdown voltage between the external conductor layers 154 and 156, a thin plate as of Al<sub>2</sub>O<sub>3</sub> is provided between the low impedance portion 11 and the high impedance portion 12.

While Inoue does mention that the PbO, ZrO<sub>2</sub> and TiO<sub>2</sub> are mixed with “very small amounts of impurities”, there is no indication that these impurities include Mn or Nb, much less in the amounts claimed. It is further noted that the amounts of Mn and Nb would not appear to qualify as very small amounts relative to the Pb, Zr, Ti and O in the claimed general composition.

Kikko, which was applied against dependent claim 12, is not understood to remedy the foregoing deficiencies of Inoue. The undersigned is not fluent in Japanese and is therefore relying solely on the English-language abstract of Kikko. However, upon purely visual inspection, the Japanese text does not appear to include the claimed composition.<sup>4</sup>

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<sup>4</sup> It is, of course, possible, that the claimed composition is represented by the hiragana, katakana and/or kanji present in Kikko; however, the undersigned is unable to determine for certain if that is the case.

In the Office Action of March 21, 2008, the claims were also rejected over Inoue and Kikko. That Office Action stated the following with respect to former dependent claim 15 (claim 10 now includes the features of former dependent claim 15).

Regarding claims 13-15, the Examiner takes Official Notice that it is well known in the art to replace part of the Pb with low valence cations. It is old and known in the art to improve the piezoelectric characteristics of a dielectric material by replacing Pb with cations, such as Mn, Nb, La.

Therefore, it would have been obvious at the time of the invention was made to improve the piezoelectric characteristics of the PZT films by replacing some of the Pb with other cations. 5

As explained above, neither Inoue nor Kikko discloses using Mn or Nb as a dopant for PZT ceramic. Official notice, however, was taken that it is well known to improve piezoelectric characteristics by replacing Pb with Mn or Nb. Even if this were the case (a point which we do not concede), there is certainly no disclosure or suggestion in the art to combine the elements in the particular proportions set forth in claim 10, namely  $Mn_{1/3}Nb_{2/3}$ . According to the Applicant, the specific replacement of parts of Zr and Ti by a mixture of Mn and Nb in the claimed ratio (namely,  $Mn_{1/3}Nb_{2/3}$ ) produces advantageous properties in the resulting ceramic material. For example, the resulting ceramic material has a good quality factor ( $Q_m$ ), reduced dielectric loss, and provides an increased electromechanical coupling coefficient. Accordingly, the claimed composition, in the context of a piezoelectric transformer, is believed to provide patentable advantages.

For at least the foregoing reasons, it is our contention that the applied art, whether taken alone or in combination the Examiner's official notice, discloses or suggests at least "ceramic layers comprising a hard piezoelectric material that has a general composition of  $Pb[(Zr_xTi_{1-x})(Mn_{1/3}Nb_{2/3})_y]O_3$ ". Accordingly, we believe claim 10, and the claims that depend therefrom, to be patentable. Withdrawal of the outstanding art rejection is therefore respectfully requested.

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<sup>5</sup> Office Action of March 27, 2008, page 4

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Attorney's Docket No.: 14219-085US1  
Client Ref.: P2002,0812 US N

Finally, we note that the outstanding Office Action (of January 27, 2009) requires submission of a drawing. We will provide the requisite drawing following the panel's decision on this pre-appeal brief.

The fees for this pre-appeal brief are being filed electronically. However, if any additional fees are required, please obtain them from the deposit account 06-1050, referencing attorney docket number 14219-085US1.

Respectfully submitted,

April 27, 2009  
Date: \_\_\_\_\_

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